

# Handbook of Magnetic Resonance Spectroscopy In Vivo: MRS Theory, Practice and Applications (eMagRes Books)

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This handbook covers the entire field of magnetic resonance spectroscopy (MRS), a unique method that allows the non-invasive identification, quantification and spatial mapping of metabolites in living organisms—including animal models and patients.

Comprised of three parts:

- Methodology covers basic MRS theory, methodology for acquiring, quantifying spectra, and spatially localizing spectra, and equipment essentials, as well as vital ancillary issues such as motion suppression and physiological monitoring.
- Applications focuses on MRS applications, both in animal models of disease and in human studies of normal physiology and disease, including cancer, neurological disease, cardiac and muscle metabolism, and obesity.
- Reference includes useful appendices and look up tables of relative MRS signal-to-noise ratios, typical tissue concentrations, structures of common metabolites, and useful formulae.

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From the Back Cover

#### **HANDBOOK OF MAGNETIC RESONANCE SPECTROSCOPY IN VIVO: MRS THEORY, PRACTICE AND APPLICATIONS**

Editors

Paul A. Bottomley, Division of Magnetic Resonance Research, Johns Hopkins University, USA

John R. Griffiths, Cancer Research UK, Cambridge Research Institute, UK

In vivo magnetic resonance spectroscopy (MRS) has generated a vast cloud of scientific papers spanning numerous topics in a large diversity of journals, ranging from the physical sciences to the clinical ‘-ology’ literature. In addition, there is a vast amount of accumulated but unpublished inside knowledge on what makes a successful in vivo MRS study that is known only to its present and past practitioners. The goal of this comprehensive text, written by an outstanding group of world experts on MRS in vivo, is to steer a pathway through all of the technologies needed to perform MRS in vivo today and tomorrow, showing how to apply in vivo MRS today, what can and might be done with it, why it is useful, and how the results might be interpreted.

The book begins with a first half on methodology that spans the basics of NMR, localization methods and MRS parametric measurements. The reader will find numerous spatial localization and signal processing techniques as well as methods for measuring metabolite diffusion, pH, chemical reaction rates and chemical exchange magnetization transfer, metabolite and fat concentrations, spin coupling, and multiple quantum transitions among non-proton ( $^1\text{H}$ ) nuclei. There are “how to” chapters on performing MRS on non- $^1\text{H}$  nuclei in vivo, and the latest methods for studying hyperpolarizing nuclei and the sequences needed to realize the enormous sensitivity gains now available therefrom.

The second half of the book is comprised of applications to healthy and diseased tissues, from animal models to humans, which cover the entire body from head to limb. It starts with cells and tissue extracts, then studies of animals and organs for transplantation. This is followed by a series of critical reviews of the state-of-the-art of clinical and research applications of MRS in obesity, diabetes, heart, brain disorders and cancer. There are two reviews on the current state of clinical trials that employ MRS. The book ends with comprehensive appendices that include tabulations of tissue concentrations of NMR nuclei, common metabolites, spectral assignments, frequently-used equations, typical spectra, and common artefacts appearing in MRS in vivo, which should be of practical value.

The audience for this reference book is multi-faceted, ranging from researchers involved in MRS methodology and its applications, to clinicians and biomedical scientists wishing to comprehend the types of clinical information that MRS can deliver, and how MRS can augment our understanding of healthy and disease states. Undergraduate and postgraduate students, clinical radiological technicians and MRI scanner operators who are learning about MRS or training in magnetic resonance in medicine, as well as those just wishing to update their knowledge of current MRS methods, will find the book a useful compendium of the current state of the art of the field.

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